The Northwestern MILLER

MILLING PRODUCTION SECTION

The Effects of Variations in Temperature Of the Breaking Process

By N. L. Kent, G. J. Baker and C. R. Jones

EDITOR'S NOTE: The writers of this article are members of the staff of the Research Association of British Flour Millers, St. Albans, England and all have made many contributions, both individually and collectively, to milling technical literature.

From time to time in the course of experimental milling work in the laboratories of the Research Association of British Flour Millers effects of variation in temperature of mill feed were encountered incidentally, and eventually it was decided to make a systematic laboratory investigation of this particular subject.

Laboratory Experiments

Manitoba wheat was first cold-conditioned to 16% moisture content and then heated without gain or loss of moisture to the final temperature required. In each case the first break rolls of the laboratory mill were also previously warmed to a temperature that commercial rolls would be expected to reach if they were operating on mill feed at the particular temperature under consideration. The four-break system used formed part of a 70% extraction process and on the basis of these laboratory tests it was concluded that about 100°F. (38°C.) was the best temperature at which to send Manitoba wheat to the first break rolls. Compared with operation at ordinary temperature, (21°C.) it produced the following effects:

1. With break rolls set to exactly the same gap, the quantity of first break tails was much increased; the corresponding reduction in release was however made up by the end of the third break (i.e. without altering the second and third break roll settings).

2. The yield of bran over No. 24 wire increased from 14.8 to 15.4% whilst the particle size of the bran was somewhat larger: this was shown by the percentage of sample remaining over No. 7 wire, in a standardized sieving test, which increased from 4.8 to 8.7% (aperture widths: No. 7 wire, 3.11 mm.; No. 24 wire, 0.84 mm.).

3. There was hardly any fall in degree of cleanness of the finished bran (as shown by the fiber figure). It followed, therefore, that the released stocks showed reduced contamination with broken bran, and this was in fact confirmed by determinations of ash content of the release.

4. The yield of break flour increased from 17.7 to 18.5% whilst the yield of semolina (sizings or coarse middlings) fell from 49.1 to 46.6%.

5. The endosperm was permanently softened through the initial breaking of the wheat whilst warm. As a result, the total percentage release of flour from the small middlings rose from 90.5 to 91.8%.

6. As a result, presumably, of the easier reducibility of the endosperm, the straight run flour extraction rose from 69.3 to 70.5% but its ash content and grade color value fell by about 0.02% and 0.4 unit respectively.

In experiments at temperatures above 38° C. many of these effects increased still further. Figs. 1 and 2* show, respectively, the first break tails and the brans resulting from laboratory milling of Manitoba wheat at 54° (left-hand specimens) compared with 18° C. (right-hand specimens). Above 38° C. however it became rather more difficult to clean the bran and, on balance, there seemed to be no advantage in raising the temperature above about 40° C.

Factors in Differences Observed

In explanation of these physical differences in breaking behavior, it is believed that the effects are mainly due to modification in endosperm properties, and that the striking effects on shape and size of bran pieces are really dependent on this factor. When warm, the endosperm becomes to some extent plastic so that the grain as a whole can readily be deformed by pressure.

To draw a rough picture, so far as the bran is concerned, the effects of milling cold and warm wheat, respectively, may be said to resemble the effects of hammering a paper bag when stretched round a flint and when stretched round a lump of chalk. Far more damage will be done to the envelope in the former case than in the latter before the contents are broken down to a similar extent in the two cases. The effect is illustrated by Fig. 3, which shows characteristic pieces selected from two samples of bran. Those on the left, which are from warm wheat, show the flute marks as ridges on the outer surface, with few signs of tearing. Those on the right, from cold wheat, show conspicuous tears in association with the flute marks.

The increased plasticity of the warm endosperm disappears when it is cooled. If, however, the endosperm is squeezed while warm, an effect is produced that remains permanently after cooling. This effect is manifest visually in increased mealiness and tactually in greater friability. Fig. 4 shows the effects of various treatments on grains from a sample of Manitoba wheat that had been moistened to 16% moisture content. The grains of the top row had received no treatment, other than the cold conditioning to 16% moisture content, before being cross-sectioned. The second row is of wheat that, in addition, had been heated to about 54° C. for half an hour and cooled before cutting. The grains in both these rows are substantially vitreous. The third row shows grains that had been nipped between smooth rolls at room temperature. The roll gap was 2.4 mm. and the wheat (at 16% moisture content) had been previously sieved through No. 7 and over No. 10 wires (aperture width: No. 7—3.11 mm.; No. 10—2.10 mm.) to ensure greater uniformity in grain size. The bottom row shows grains treated similarly except that both the wheat and the rolls had been heated to about 54° C. before the nipping took place. The mealiness resulting from this treatment is caused by the production of numerous cracks or planes of cleavage in the endosperm whilst still in situ within the grain. Examination of particles subsequently released from such grains suggested that the cracks tend to run across the endosperm cell contents rather than between the cells.

In order to test these findings on the commercial scale, Henry Simon

(Continued on page 15a)

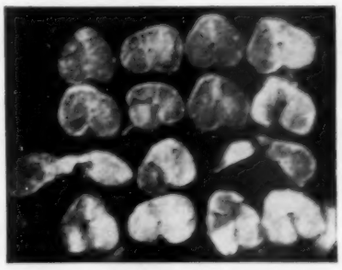

Figure 4

Cross sections of Manitoba grain at 16% moisture content: top row, cold conditioned; second row, wheat stewed at 130°F. for 30 minutes, cooled before cutting; third row, cold wheat nipped between cold smooth rolls; bottom row, warm wheat nipped between warm smooth rolls.

Figure 3

Brans from laboratory milled wheat: left, warm milling, tooth marks visible as ridges; right, cold milling, bran is torn.

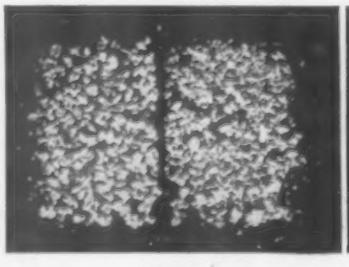

Figure 1

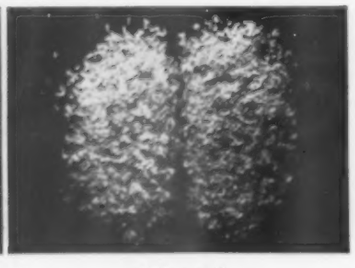

Figure 2

First break tails from laboratory milled Manitoba wheat are shown in the picture on the left. The first section is of wheat and rolls at 130°F., the second shows wheat and rolls at 65°F.

*It is hardly possible for photographic reproductions to convey an adequate impression. The actual difference is most striking to anyone making a comparison experimentally for the first time.

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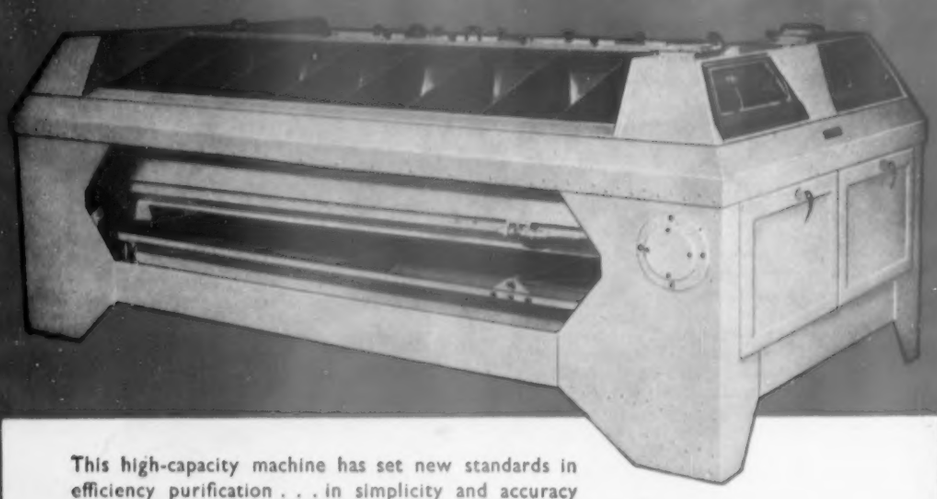

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OGILVIE MILL FEATURES—Left, the bottom floor of the mill, showing the conveying pipes and finished product weighers. Center are the roller mills, on breaks, scratch and some reductions. The third picture shows the top floor of the warehouse. At left are the receivers for the bulk system.

Ogilvie Builds Third Unit in Montreal Plant to Give Increased Capacity

Firm Pioneered In Flour Trade

Ogilvie Flour Mills Co., Ltd., with headquarters at Montreal, has been in the van of flour milling progress throughout Canada for many years. H. Norman Davis, president of the firm, has sparked an enthusiasm in his technical staff that has resulted in great care being taken to insure that only the best of modern developments are available for use in the Ogilvie chain of mills. The process of modernization is a continuing one and constant renewal of equipment is the policy of the firm.

Before plans were made for the new milling unit at Montreal a detailed examination of the products of all engineering firms was made. Finally, it was decided that the work should be done by the British firm of Henry Simon, Ltd., and the Swiss firm of Buhler Bros.

Firm's History

Founded in 1801 in Quebec by Alexander Ogilvie, son of a Scottish immigrant, the firm moved to Montreal in 1811, and in 1837 settled on a site at St. Gabriel Lock on the newly constructed Lachine Canal. It was built into an internationally known business in the second half of the 19th century by Alexander's three sons, Alexander Walker Ogilvie, John Ogilvie and William Watson Ogilvie.

In 1871 Alexander Walker Ogilvie, after a trip to Hungary, introduced iron reduction rolls, and in 1885 the company made the first export of flour from western Canada, where the Ogilvie brothers had done a great deal to encourage the cultivation of hard spring wheat—they brought in the first seen in Canada, 800 bu. from Dakota Territory, in 1874. Their interest in grain supply led them to build a chain of elevators across the Canadian west, but their chief interest was in flour milling and exporting. In 1886 they built the Royal Mill on the same site as the present mill at Montreal, with a capacity of 2,100 bbl. It, too, had all the latest devices —including an early electric light plant that had to be watched continually by a man armed with a bucket of water to put out the fires it started.

By the end of the century, with mills at Seaforth, Goderich and Winnipeg, in addition to the Royal Mill and the City Flour Mills at Montreal, A. W. Ogilvie & Co. was Canada's leading milling company—in 1894, C. A. Pillsbury toasted William Watson Ogilvie as "the largest individual flour miller in the world."

William Watson Ogilvie died in 1900. On the death of Alexander in 1902, the firm was formed into a public company—Ogilvie Flour Mills Co., Ltd.

The early years of the century saw Canada emerge as the world's greatest exporter of wheat and flour, and the Ogilvie company grew with the opportunity. In 1906, a 2,500 bbl. mill was opened at Fort William, and by 1913, with another new mill at Medicine Hat working, 30% of all Ogilvie flour was exported. Satisfied customers included Britain's King George V (by Royal Appoint-

(Continued on page 18a)

Modernity Paramount

Work on a new building for the Royal Mills of Ogilvie Flour Mills Co., Ltd., Montreal, was started in 1941 but it was not completed until 1945. Designed for a capacity of about 10,000 sacks a day, full operation was reached in 1948. Space was left for a 1,200-sack semolina mill and cleaning house though these were never installed. The directors decided that the space could be more usefully employed for another flour mill to supplement the two already operating.

The aim was to increase the flexibility and efficiency of the whole group. Thanks to the saving in space made possible by the development of pneumatic conveying and the introduction of high-capacity machines, the space available was sufficient to

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Some Firsts

Officials of Henry Simon, Ltd., builders of the mill in conjunction with Buhler Bros. of Switzerland, say that it is the first mill in the Western Hemisphere to employ their high speed pneumatic system, instead of the more usual diffuser system, and the first mill in the world to be fully equipped with the new Simon SDQ superimposed purifiers. Also, the officials say, it is the first mill in North America to have a Simon bulk flour handling plant.

Many projects were considered and eventually it was decided to install a European-designed mill. In the spring of 1955, John Willis, general superintendent of the company, made a tour of Europe, visiting several mills and conferring with the leading mill engineers. On the basis of his report and recommendations the contract for the mill and process plant was awarded to Henry Simon, Ltd. of Stockport, England, and that for the wheat cleaning plant to Buhler Bros. of Uzwil, Switzerland.

The company was anxious to have a high-speed pneumatic system in the mill as this would fit best into the space available. When Mr. Willis visited the Stockport firm he was shown a complete high speed plant working in the Simon experimental mill alongside the more normal diffuser system, and he was able to see similar Simon plants working in mills on the continent. It is this system that has been adopted for the new plant in Montreal.

The wheat cleannig plant has a Buhler pneumatic system. The wheat lifts are blown up under pressure. A Millerator and Carter Disc Separators are used, followed by washers and Viskators. Conditioning is on the continuous automatic system, the wheat lying for 24 hours in the tempering bins.

The mill is designed on the Simon system, giving a well balanced flow with sufficient surfaces at all points and correctly selected covers, all suitably adapted for the types of wheat being ground, the types of product required and the conditions under which they will be working.

TOP FLOOR — This picture shows the top floor of the new Ogilvie flour milling unit with cyclones and dust collectors.

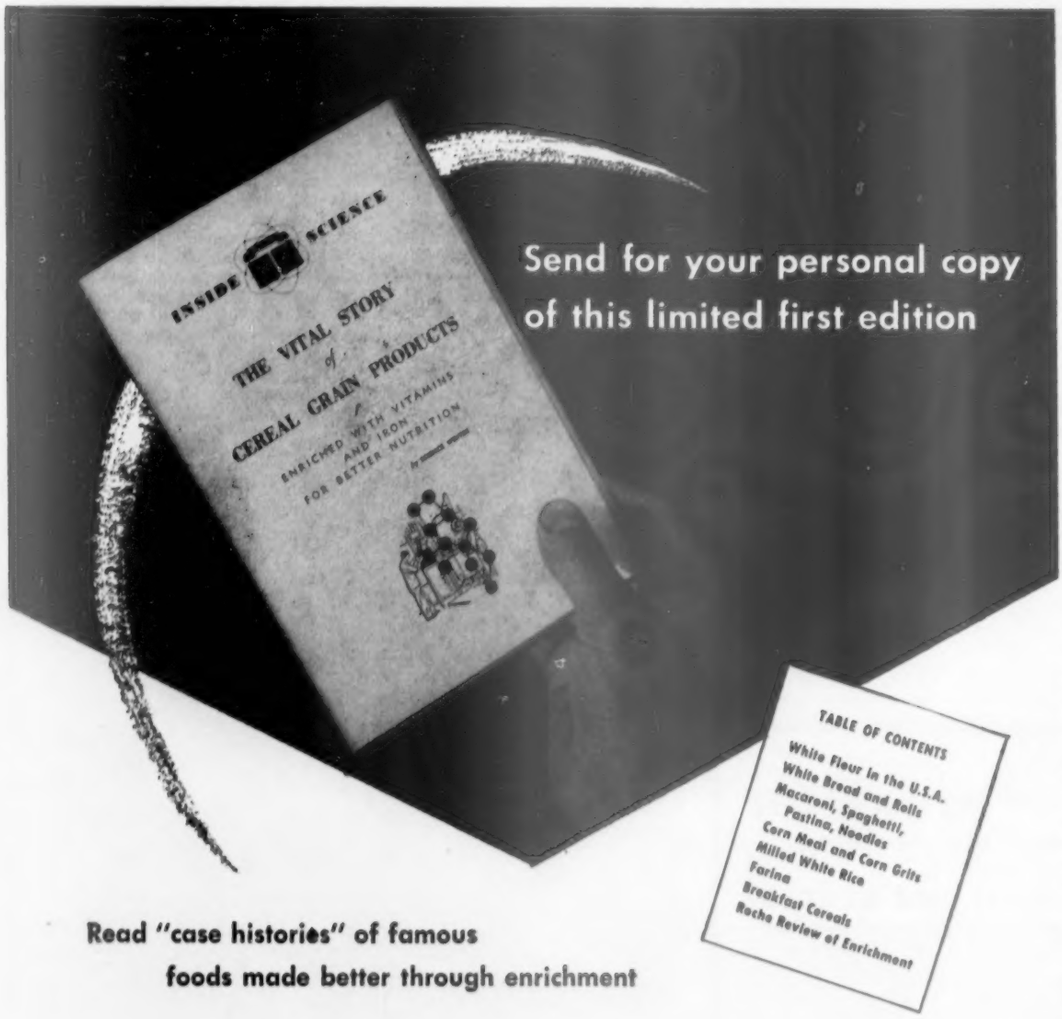
There are 55 lifts in the mill, divided into three systems. The initial capacity of the mill is 4,000 sacks a day, but sufficient reserve has been provided on the pneumatic plant to enable this to be raised to 5,000 sacks. Each system has a 64-sleeve Simon dust collector, and special small cyclones are used on all lifts. Dust collector discharge and any choke stock are fed into the II and IV break lifts and the V break lifts respectively by Simon Velofeeders.

Rollermills

The rollermills are of two types. Eighteen Simon type GC 40x10 in. machines are employed on the breaks, scratch and some reductions, with 12 Buhler type MDD 1,000x250 rolls on the remaining reductions. Where necessary the break rolls are fitted with the Rollmaster device, and the reduction mills have frosted rolls. The Simon rollermills have Simon-Hoffman roller bearings, and they have all been "bug-proofed" and fitted with concrete hoppering, with steel hoppers to connect to the metal spouts.

The break scalpers and the sifters at the head of the mill are the Great Western Manufacturing Co.'s HS machines—five of them—while the reduction dressing is carried out by five standard Simon Flowmasters. Rotatubes—aluminum outlet spouts set in rubber so that they can follow with ease the movements of a swinging or oscillating machine—have replaced socks on both feed and delivery spouts of both types of sifter.

An entirely new machine is used for the purification. It is the Simon type S, quadruple purifier—essentially two exceptionally low, aluminum Simon machines superimposed. These are all equipped with double deck sieves. Rotatubes are fitted to the outlets of both top and bottom purifiers, and have enabled the design to be kept neat and compact. Only 5' 6" wide, 9' long and 7' high, the new machines take up only a little more room than one conventional purifier while doing several times the amount of work, Simon states. The type "S" Purifier was developed specially for the requirements of millers in the U.S. and Canada. It takes into account the need for carrying heavier loads in confined spaces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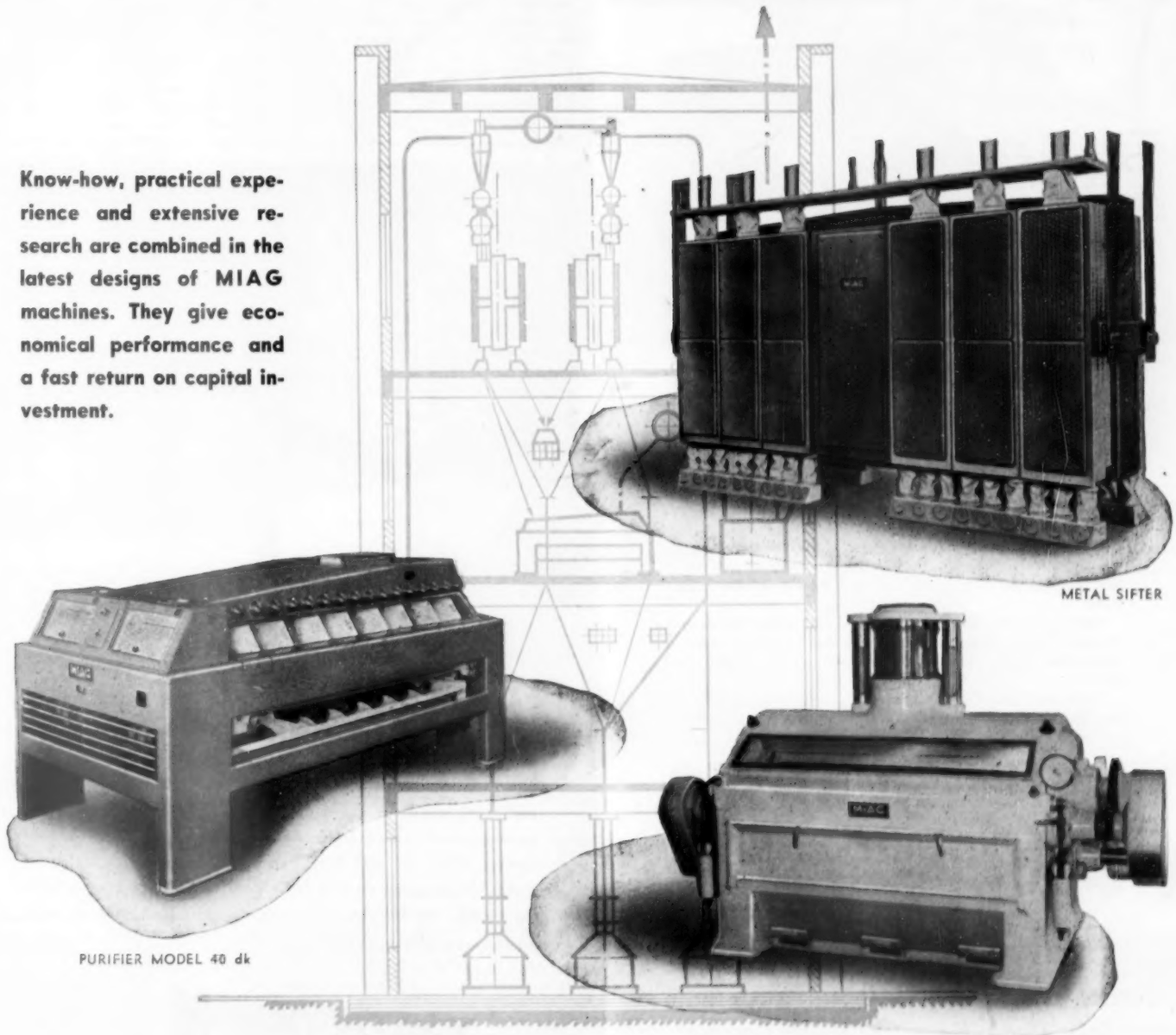

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and it simplifies maintenance and supervision. Specially designed feed gates are capable of spreading even the most difficult of mill stocks. The double-decked sieves have reinforced sieve frames in order that the heavier loads may be carried. Places where infestation can lodge have been eliminated and the new type of vibrating spout has assisted sanitation.

The power installation has also been done by Simon, in conjunction with Canadian subsidiaries of British firms. The Ogilvie company is adhering to the practice of driving all machines in groups, as far as practicable—the rolls and purifiers are driven from one 450 H.P. motor, and the sifters from one of 40 H.P. The pneumatic fans, dust collectors, pneumatic seal systems and purifiers exhaust fans, as well as the pneumatic conveying fans, each have individual motors suitably interlocked.

From the mill the products go to bulk storage via Richardson Scale Co. automatic weighers, and are elevated to the existing bulk bins by means of a Simon blowing system. Each automatic weigher—there are seven of them, for four types of flour, bran, shorts and middlings — discharges via a seal into a high-concentration blowing line, in which the stock is elevated to a receiving hopper above the bins. The new unit makes use of the existing bulk flour storage facilities and the stock is distributed from the receiving hoppers to the bins by existing screw conveyors. Flour is drawn from the bins and conveyed to the packing plant, which consists of new Bemis and Richardson high speed flour and feed packers. Before packing the flour passes through Gyro-Whip sifters and Entoleters into reserve bins above the packers.

Careful and efficient planning has enabled this mill, with a maximum capacity of 5,000 sacks, to be planned in less than half the space required by each of the other units in the Royal mill, which were installed less than 10 years ago. This, officials comment, is some measure of the progress made in mill planning, the development of high capacity machines, simplicity of design, labor saving operation and ease of supervision in a modern mill designed by milling engineers of world-wide experience. The entire plant, comprising mill and screenroom, is supervised by two men to a shift.

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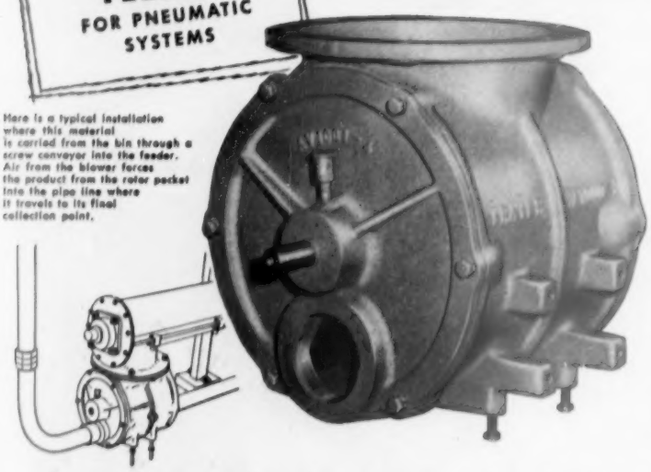

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Relationship of State Wheat Quality Laboratories to Regional Wheat Quality Laboratories

By John A. Shellenberger

EDITOR'S NOTE: Dr. J. A. Shellenberger is department head of the flour and feed milling industries, Kansas State College. The article was presented as a paper at the Wheat Institute, Stillwater, Okla., earlier this year. It is contribution No. 269 Department of Feed and Flour Milling Industries, Kansas Agricultural Experiment Station, Manhattan, Kansas.

The wheat breeder needs the services of the cereal chemist early in the development of new wheat varieties because the baking quality characteristics of all new wheat selections must come from the cereal laboratory. It probably is of no particular importance whether the information regarding quality which is supplied to the wheat breeder comes from a commercial, state or regional wheat quality laboratory. The important considerations are the adequacies of the laboratory staff and equipment and the accuracy and useableness of the report which help the wheat breeder decide which selections to continue and which to discard.

Where a state experiment station has full time U.S. Department of Agriculture agronomists engaged in wheat breeding activities assigned to the station, it would seem appropriate that the testing program be also conducted by one of the four regional wheat quality laboratories.

On the other hand when the wheat breeding program is principally manned and financed from state funds, it would be logical to expect the state to provide the staff and facilities for testing new wheat selections if wheat is an important crop within the state. In most states wheat is not of sufficient economic importance to warrant the establishment and maintenance of a wheat quality laboratory and technical staff. In such instances the wheat quality evaluation work should be done by a cooperative agreement with one of the field crops research branch laboratories of USDA or at one of the cereal laboratories operated under state experiment station jurisdiction. In either case the best way to keep the wheat breeding field work in balance with laboratory testing facilities is to have both phases of the work tied together by means of a common budget.

A wheat breeder's dream is a quality laboratory at his disposal where all the samples he can grow will be evaluated quickly, willingly, and so decisively that it leaves no doubt in his mind as to whether or not each sample submitted should be retained or rejected. On the other hand, a cereal chemist's dream of Utopia is a well-equipped laboratory, staffed with qualified scientists with intriguing research ideas but operated completely free from the routine work of evaluating wheat samples for quality characteristics. Obviously, both the wheat breeder and the cereal chemist must make some important concessions in the interest of economy in operating a good wheat breeding program.

New crosses developed at the various state experiment stations which show promise should be grown and tested on a regional basis. Wheat varieties have no respect of arbitrary "areas of recommendation" or for state boundary lines. It is therefore of vital importance that all wheat breeders cooperate in the regional testing program whereby new crosses are grown in several different geographical locations where agronomic and quality characteristics can be compared with standard varieties grown under similar conditions. The coordination and the quality evaluation of new varieties grown in the regional plots should be a function of the field crops research branch of USDA. A strong regional testing program provides basic data on all new varieties which might be introduced into a production area, and this information cannot be obtained adequately year after year by any other means.

When, on the basis of regional testing, a variety appears to have promise and might be considered for release, it should be grown at a number of locations within the state or states of adaptation. The samples grown should be thoroughly tested for quality at state laboratories whenever possible. The state program can, of course, go on simultaneously with the regional program and this is the ideal situation. Just as it is the prerogative of state experiment stations to announce the release of new wheat varieties, it should be a privilege as well as an obligation for the state agricultural experiment stations to conduct all

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phases of the testing program, including baking quality evaluations, where facilities are available.

In addition, before a new variety is approved for release, it should be grown at several localities under comparable conditions with wheats of known quality characteristics and in sufficient quantity to be milled into flour on a pilot plant scale. The flour should then be distributed to flour mills and bakeries for commercial appraisal. This action should be taken at least one year before a new wheat variety is approved for release.

The proper use of regional and state wheat quality laboratories, combined with the opinions obtained from industry, provides a means for the thorough testing on both a regional and state basis of all new wheat varieties. Thus, there is a triple check on quality determinations and interpretation of quality data, since three independent groups are passing judgment on the characteristics and anticipated acceptability of each new wheat variety. The trend in recent years is toward the establishment of wheat testing laboratories in the major wheat producing states. Probably this trend will continue as wheat interests become better organized and financed. Several states have enacted legislation which provides funds by an assessment on wheat at point of first sale. Several states have legislative action pending and in several other states there are groups actively working toward such legislation. Also, large sums of money for wheat research are raised by voluntary contributions from sources closely associated with the wheat industry.

It can be expected that as funds become available new wheat quality testing laboratories will be established. These laboratories can be of real service to the wheat improvement program of the respective states. It is difficult on a regional basis to plan adequately for the fluc-

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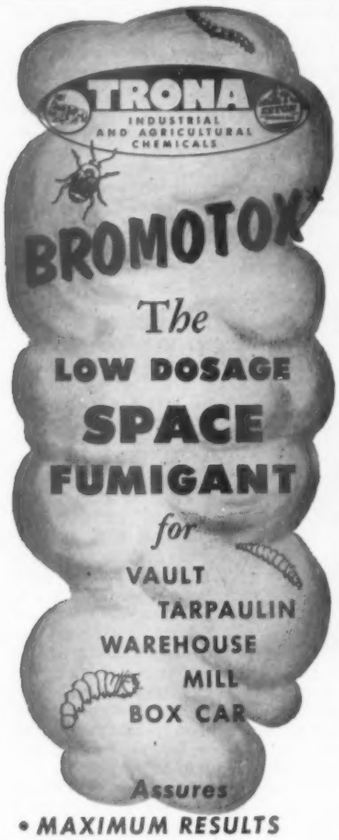
tuating work load associated with programs which originate in different states. The work load may vary several fold from one year to another, depending upon the weather, extent of wheat breeding work undertaken at each station in a given year, and the urgency of developing new varieties at a particular time. These fluctuations in work load can be much more effectively anticipated and planned for at the state level than by a regional laboratory. Also, state laboratories can readily enter into the testing of wheats which are produced in connection with a wide assortment of problems, other than new wheat developments, such as the influence of fertilizers, irrigation, seed bed preparation, time of planting, etc. on the physical, chemical, and baking properties of wheat.

You will note that the words "wheat quality research" have been conspicuously absent from this discussion. The day when wheat quality research involved merely the establishment of a cereal laboratory and the employment of a chemist has long since passed and surely no one continues to believe that the routine testing of new wheat varieties constitutes research. Wheat quality research has become complicated and expensive. If it is to be developed to a scientific level, comparable with other fields, it needs to be centralized and not dispersed into many separate laboratories with small staffs, inadequate research equipment, and limited time and experience in research.

Summarizing, there is then a legitimate place for both regional and state wheat testing laboratories. Both can serve a most useful purpose and provide a sound and thorough testing procedure for new wheat releases.



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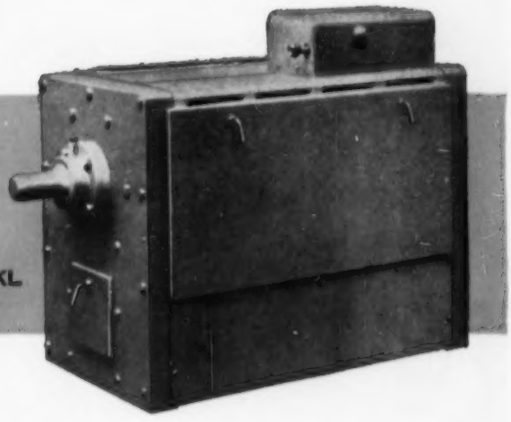

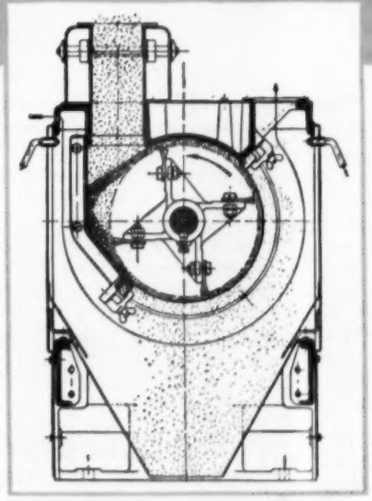

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Safety in the Milling Plant

● By Ernest W. Fair

Few safety programs overlook the importance of the individual employee's actions on the job. Few ignore the need for training in proper action and motion by the employee. Far too many ignore the importance of applying safety to the equipment as well.

No piece of equipment is fool proof or accident proof. Some may have greater accident potential than others but all possess it to a degree. The safety program of the mill should therefore call for close attention to application of safety with respect to the equipment therein.

Here are presented a number of accident areas which deserve such attention. Overlooking even one can nullify all the work and effort expended on the program.

Wherever there are dangerous moving parts these should be enclosed. There should be no exceptions. Many units in the plant have such guards or enclosures as integral parts of the machinery itself but others do not. It should always be a rule that where there are moving parts some sort of substantial guard must be erected.

No such guarding or equipment placement should ever be made which will make it difficult for employees to reach parts subject to wear, adjustment and hand lubrication. All should be conveniently accessible. In some cases it will even be profitable to go to the expense of moving such units to assure this requirement is present. In others, redesign of guards or housing may provide the safe accessibility. A particular point to look for is the situation where accessories have been added which create such a condition.

Added safety can be obtained where old equipment is still in use by installation thereon of automatic and continuous lubrication systems which permit oiling while the machine is in operation. This is a feature of most modern equipment. Oiling systems are available or can easily be devised in the plant shop for the older units. This will eliminate a very prevalent cause of accidents—injuries to employees sustained while lubricating machinery in motion.

Driving mechanisms always require close examination during any safety inspection. These, too, are a frequent source of accidents. Such driving mechanisms built close to the floor must always be enclosed or shielded by heavy guards. Some plants have found it worth while to move them off floors and out of reach. Others find, in some spots, it pays to convert machines to individual drives in order to eliminate this hazard.

Another big cause of accidents in many plants has been the existence of a condition of sharp contrast between light and shadow and glare in the vicinity of the point of operation of a machine. Shadows conceal danger. Heavy contrast between light and shadow makes it difficult for the worker to see what he is doing and maintain adequate alertness.

Where any such condition is found it can usually be remedied at very little cost. One method is to install proper fixtures around such areas which do away with these shadows and provide uniform lighting around the equipment and in work areas where employees use each such piece of equipment. Another is to use paint to provide color contrast as well as kill out shadow effects.

Injuries are naturally often sustained by workers reaching into or about equipment for materials in the process of feeding or extracting from the unit. Where this is done by hand, provision of a mechanical means of doing so will always lessen the accident hazard. Provision of additional free space around such a unit in order to give the employee more room in which to maneuver is another method.

Dust and Gases

Long range hazards in the form of dust and gases should also be taken into consideration. The ill effect from these is not always readily apparent and shows up only after a considerable period of time. They are as much of an accident hazard as an unguarded high-speed machine. Where they do exist in the plant the easiest and best method of doing away with them is to provide automatic suction blowers and a duct system to carry such damaging fumes or gases outside and away from the work areas.

Noise is some times a contributing factor to accidents in the plant. Wherever it exists in excessive volume it serves to decrease the alertness of employees and increase their nervous tension. Any employee, under these two extremes of stress, is a potential accident victim no matter how well trained in safety he may be.

Reduction of such extreme noises is always possible through the erection of sound proofing partitions around such equipment, damping of the unit itself in and around its foundation and by other well known methods. The important factor is that noise as a contributing cause of

(Continued on page 14a)

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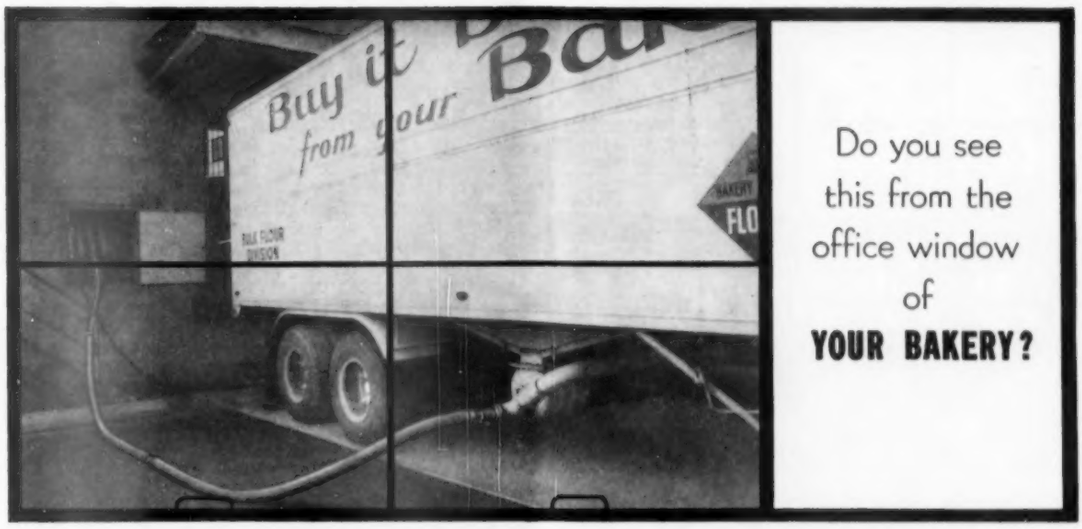

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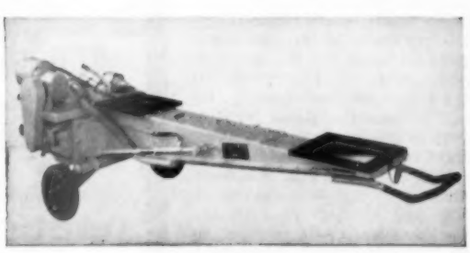

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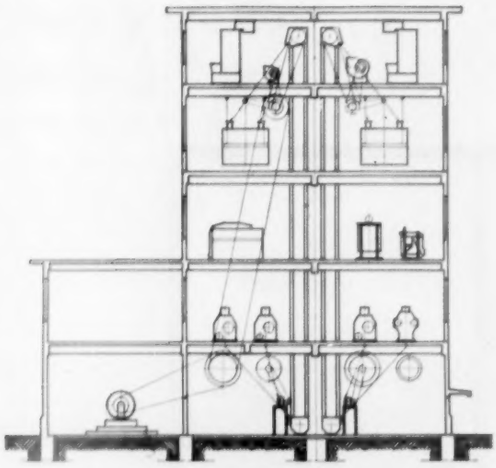

Abbildung 1

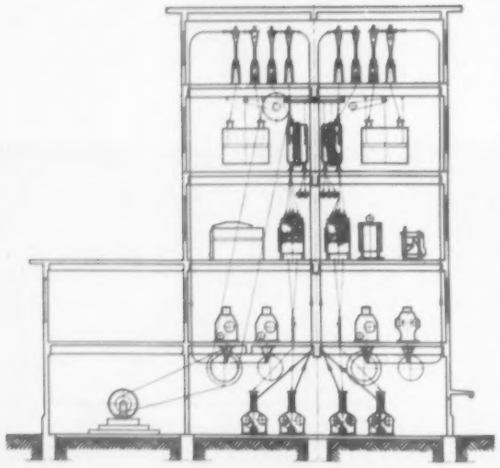

Abbildung 2

Building a 3-in-1 Flour Mill

The German machinery manufacturing firm of MIAG was recently presented with a difficult problem by a miller in the Far East. His building already housed two separate units; the requirement was for a third unit in the same space.

The company needed to regain the mill capacity of a destroyed plant as a matter of urgency. Neither time nor money were available for a new building, or for extending the old.

The picture that confronted the MIAG engineers when surveying the job is illustrated in the cross section of the mill shown in Figure 1. In the center of the drawing are the familiar elevator legs.

The suggestion that pneumatic conveying of mill stock be introduced for the existing two units was accepted. The space gained by removing the elevator legs was utilized for installing narrow drawer-type sifters and quadruple purifiers, the latter at right angles to the existing equipment. Roll stands, type HNP, for the new unit were placed in the basement. This type has pneumatic inside pickup nozzles and can be p'aced in a basement since no space is required under the machine itself. Despite the presence of the roller mills in the basement, space was available for storage. Previously, no such space was available in that area because of the room taken up by elevator boots, spouting and the like.

The finished three-part mill is illustrated in Figure 2, with the new equipment shaded-in.

Conversion to pneumatic conveying and the installation of modern space-saving equipment not only provided floor space for a new milling unit, but also saved time and money on a new building. The MIAG engineers stress that they do not consider this to be a general pattern in mill building, but it does illustrate the practical way in which a mill owner's demands can be met.

Creta Praeparata; Reasons for U.K. Admixture Policy

EDITOR'S NOTE: American and Canadian millers have, on occasion, expressed surprise at the British insistence upon the admixture of calcium carbonate in the form of prepared chalk in both home-milled and imported flour. In this article the science editor of Milling, the Liverpool trade publication, explains the reasons motivating the British nutritional authorities in their demands for the use of chalk as an additive to flour.

v v

Fortification of flour with calcium carbonate in the form of creta praeparata was made compulsory by the British government in 1943. The main reason behind the step was a fear that the increased intake of phytic acid consequent upon the imposition of a higher rate of extraction might cause the available calcium in the national diet to fall below a desirable level. Four years later, although the rate of extraction had been reduced, the regulations were changed so as to require the proportion of creta added to flour to be raised from 7 oz. to 14 oz. per sack of 280 lb.

Nutritional Significance

At this stage it may be helpful if we review briefly the nutritional significance of calcium and phytic acid. The bones of our skeletons and the substance of our teeth are composed largely of calcium phosphate and hence at all stages of our life our diet must provide us with a sufficiency of absorbable calcium and phosphorus. In childhood and adolescence calcium is required for an extension of the bone structure of our bodies and for the growth of our teeth, but even when adult life is reached and growth and tooth formation have ceased calcium is still required. Decalcification of the bones is constantly taking place in an adult and the calcium thus lost from the skeleton has to be replaced by calcium absorbed from the diet. If sufficient calcium is not absorbed by growing children mal-formation of the skeleton or even rickets may occur.

Phytic acid will combine with calcium, and as the compound so formed is insoluble in the digestive juices the calcium in it is unavailable to the body. If we consume phytic acid, therefore, an equivalent amount of calcium in our diet will be immobilized. The phytic acid in whole-meal flour is considerably greater than that required to combine with the calcium in the flour, and the excess is able to immobilize calcium supplied by other foods in the diet. Hence, the substitution of wholemeal bread for white bread in a diet automatically reduces the consumer's calcium absorption.

The phytic acid content of flour is proportional to the bran content and consequently the higher the extraction the greater the need for calcium supplementation as a counter measure to calcium-immobilization. At one end of the scale is wholemeal flour which will render nonavailable to the body some of the calcium in the other foods of the diet, while at the other end is patent flour which contains scarcely any phytic acid. When calcium supplementation is employed as an antidote to phytic acid, therefore, it should be added in relatively substantial amounts to wholemeal but not at all to patent flour. At the present time the reverse holds good; patent flour is required to contain 14 oz. of creta praeparata in each 280 lb., whereas wholemeal, with its higher phytic acid content, is absolved from fortification. The reasons given for the anomalous situation are that no longer is creta added solely as an antidote to the phytic acid in the flour which carries it, but as a means of increasing the over-all calcium intake of the population, and it is omitted from wholemeal as a sop to the small faction which clamours for a natural flour with nothing taken away and nothing added.

Requirements for Health

The question now to be examined, therefore, is whether the calcium intake of the population at large is such that the widespread administration of this nutrient by flour supplementation is necessary as a safeguard to the health of the nation. Our starting point must be the calcium requirements for health. These will vary with age but when the problem is surveyed on a national scale a single per capita figure must be used. The obvious figure to take is that recommended by the committee on nutrition of the British Medical Assn. since this was accepted by the Ministry of Food in its nutritional surveys. The B.M.A.'s recommendation is 917 mg. of calcium a day.

The National Food Survey Committee's annual reports on "Domestic Food Consumption and Expenditure" give the following figures for the national average calcium content of the domestic daily diet:

Yearly average, 1950	1,066 mg.
Fourth quarter, 1951	1,059 mg.
Yearly average, 1952	1,043 mg.
Yearly average, 1953	1,040 mg.

Each of these figures is well above the 917 mg. recommended by BMA but in order to evaluate the adequacies of the national diets it is necessary to make adjustments for meals taken outside the home and to apply a deduction (10%) to allow for wastage, spoilage and food given to domestic pets. When these allowances are applied and the resulting figures are expressed as a percent-

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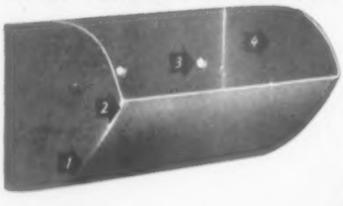

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CALUMET CUPS

age of the BMA's recommendation, the following figures are obtained:

National Average Daily Calcium Intake Expressed as a Percentage of BMA's Recommendation

Yearly average, 1950	109%
Fourth quarter, 1951	111%
Yearly average, 1952	108%
Yearly average, 1953	108%

The foregoing figures make it clear that the national average intake of calcium was adequate for the four years 1950-1953; data are not available for the years subsequent to 1953 but there is no reason to believe that the position has been radically different during the last two or three years.

It might be argued that a "national average" figure could give a false impression in that the intake of a particular nutrient was well above the optimum in an upper social class of consumers and significantly below the optimum in a household where the income was much lower. This point has been taken care of in the reports of the National Food Survey Committee where the intakes of various nutrients in households of different social classes are recorded. The figures for calcium reveal that while households of the lowest arbitrary income group (gross weekly income of head of household less than $18) consumed rather less of this nutrient per head per day than the households of the social class in which the gross weekly income of the head of the household was over $45, nevertheless their calcium intake was 110% of the BMA recommendation. The lowest calcium intake was found among the intermediate social classes but even there it was 107% of the recommendation.

The picture becomes somewhat different, however, when households with three or more children or with children and adolescents are surveyed. In such families the calcium intake varied from 87% to 94% of the amount recommended by BMA in the years 1950 to 1953. The extent to which the position of these households with respect to calcium would be worsened if flour were not supplemented with creta depends upon two factors—the amount of flour consumed and the proportion of the calcium content of flour contributed by creta. The calcium content of the natural ash of flour is very low and accounts for only about 20% of the total calcium present in flour fortified with 14 oz. of creta a sack. Hence, if the statutory addition of creta to flour were stopped, bread and flour would contribute to the diet only about one-fifth of the amount of calcium they supply at present. Since bread and flour account for about 30% of the total calcium consumed in the diet, the disappearance of 80% of the calcium from these foods would obviously be of nutritional significance. Adjusting the figures of the National Food Survey Committee's reports on the basis of flour and bread from which creta is absent, the calcium intake of families with children and adolescents would be well below the recommended level; the intakes for 1952 and 1953 respectively expressed as a percentage of the BMA recommendation would be about 70% and 60%. If a similar adjustment is made to the average intake of calcium for all households during 1953, the figure falls from 108% to about 85% of the level recommended by BMA.

The published data which have been quoted would suggest, therefore, that if the regulations requiring white flour to be fortified with 14 oz. creta a sack were rescinded, then the average national intake of calcium would fall significantly below the level recommended by BMA and the discrepancy would be even greater in those families which included children and adolescents. If the population were to be forced to eat wholemeal bread which contained no added calcium the position would be worse because the reduced intake of calcium would be aggravated by the immobilizing effect of the phytic acid of the wheatmeal on some of the calcium supplied by other foods in the diet. It is worthy of note, however, that the BMA committee on nutrition commented upon the recommended intake of calcium in the words: "On the other hand, the committee is impressed by the growing body of evidence indicating that the human body readily adapts itself to live economically and effectively at levels of calcium intake considerably lower than those represented by these figures."

Nevertheless, it decided that there was insufficient quantitative data regarding maintenance of good calcium balance on relatively low intakes to justify a departure from the recommended levels, and, as has been shown in this article, these levels would not be attained on the present average diet if we dispensed with the fortification of white flour with creta.

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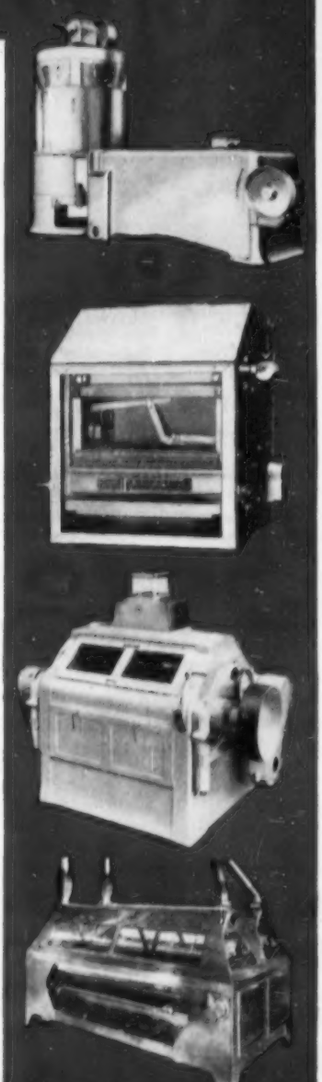

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SAFETY

(Continued from page 10a)

accidents is generally overlooked. It should be placed high on the list in every plant and where accident prevention methods are being planned the elimination of unnecessary noise should be near the top of the list.

Excessive Vibration

Excessive vibration has the same effect. This usually results from lack of good maintenance on equipment. It should never be overlooked as a contributor to accidents in any plant.

Many accident surveys have pointed up another frequently overlooked mechanical cause of accidents. This involves machine motion itself. Any machine motion that is tiring to the eyes of the worker should be avoided as where reciprocating or revolving parts are viewed through cross screens or latticework.

Added safety can also be secured around moving parts of equipment that cannot be enclosed by smoothing the contour of such equipment. Wherever exterior shapes of any parts of the machines that require frequent handling exist they should be set up to facilitate convenience in handling.

Many accidents are caused by employees tripping or falling into machinery. These can be avoided by enclosure of such parts of the machine or by providing guard rails which will catch the individual and give him the needed second or two to regain his balance. Such a hazard exists frequently where units are crowded too closely together and there is no room for one to regain his balance should something happen. In some instances this type of accident has been reduced in such areas through compulsory routing of traffic of employees along other aisles in the plant and making the area virtually "off limits" to all but the men whose jobs keep them therein.

Machine safety in the plant should also be impressed upon the maintenance men therein, for maintenance men who are safety conscious can do more toward spotting and removing conditions of danger than any other single individual. Alertness on their part with regard to safety can also increase the vigilance they will display in applying proper maintenance to equipment before it can become dangerous through lack of that maintenance.

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VARIATIONS IN TEMPERATURE

(Continued from page 1a)

Ltd., milling engineers with the co-operation of J. W. French & Co. Ltd., London millers, arranged for a series of tests to be made in a commercial mill, equipped throughout with pneumatic conveying. The pneumatic conveying therefore provided for cooling the stock automatically after the heated grain had passed through the first break rolls.

A section of a radiator conditioner fitted before the I Break roll hopper enabled the temperature of the wheat to be raised immediately prior to grinding without appreciable change in moisture content. Initial trials indicated that 38-41° C. was the optimum temperature range; above 41° the stocks became too woolly. It is to be noted that in the laboratory experiments described, both the break rolls and the wheat were previously adjusted to an elevated temperature, whereas in the commercial test the wheat only was heated. Initially, however, consideration was given to the desirability of raising the temperature also of the I Break rolls themselves, say by means of a "reversal" of the well-known process of water cooling as applied to reduction rolls, but preliminary experiments on the commercial scale showed that this would be unnecessary: it was found that the heat of grinding sufficed to maintain the rolls at a temperature 5 6° C. above that to which the wheat was adjusted.

In the commercial tests the grist consisted of 50% Manitoba, 30% Hard Winter and 20% English wheat; it was therefore considerably softer and more mealy than that used in the laboratory experiments. The hard wheat was conditioned on a stabilizer working at a temperature of 54° C. and cooled in the washer in the customary way.

The following account is based on the Simon report.**

In test A, the mixture of wheats was fed to the I Break rolls at room temperature, which at that time was about 25° C. In Test B the mixture of wheats was raised to 38-41° C. by means of the radiator conditioner section above the I break rolls. The mill was allowed to settle down for a week on the warm wheat before the test samples were taken. The rate of feed of wheat to the mill was practically the same in both tests.

Moisture contents were as follows:

	Test A (cold) %	Test B (warm) %
Hard group (wheat)	15.8	16.0
Soft group (wheat)	14.9	14.5
Millfeed	15.6	15.7
Flour	14.1	14.1
Shorts	12.4	12.6
Bran	12.8	14.0

The figure for the bran in Test A seems unaccountably low. It is however evident that no increase in evaporative loss occurred in Test B.

The extraction rates and grade color values of the straight run flours are shown below:

	Test A (cold)	Test B (warm)
Straight run flour:		
Extraction (%)	80.5	80.8
Grade, color, value	6.3	6.1

The most immediate effect of sending warm wheat to the I Break was a very appreciable increase in quantity of feed to all the coarse breaks, at the expense of the subsequent fine break rolls. In order to correct the balance of feeds it was necessary to open each of the coarse scalping covers by at least one number (12 to 10 wire, etc.). It was also necessary to close the I and II Breaks very appreciably when warm wheat came on the mill, in order to obtain the same release as with the cold wheat. The following break rolls were adjusted to give the releases stated both with cold and warm wheat: (see table below).

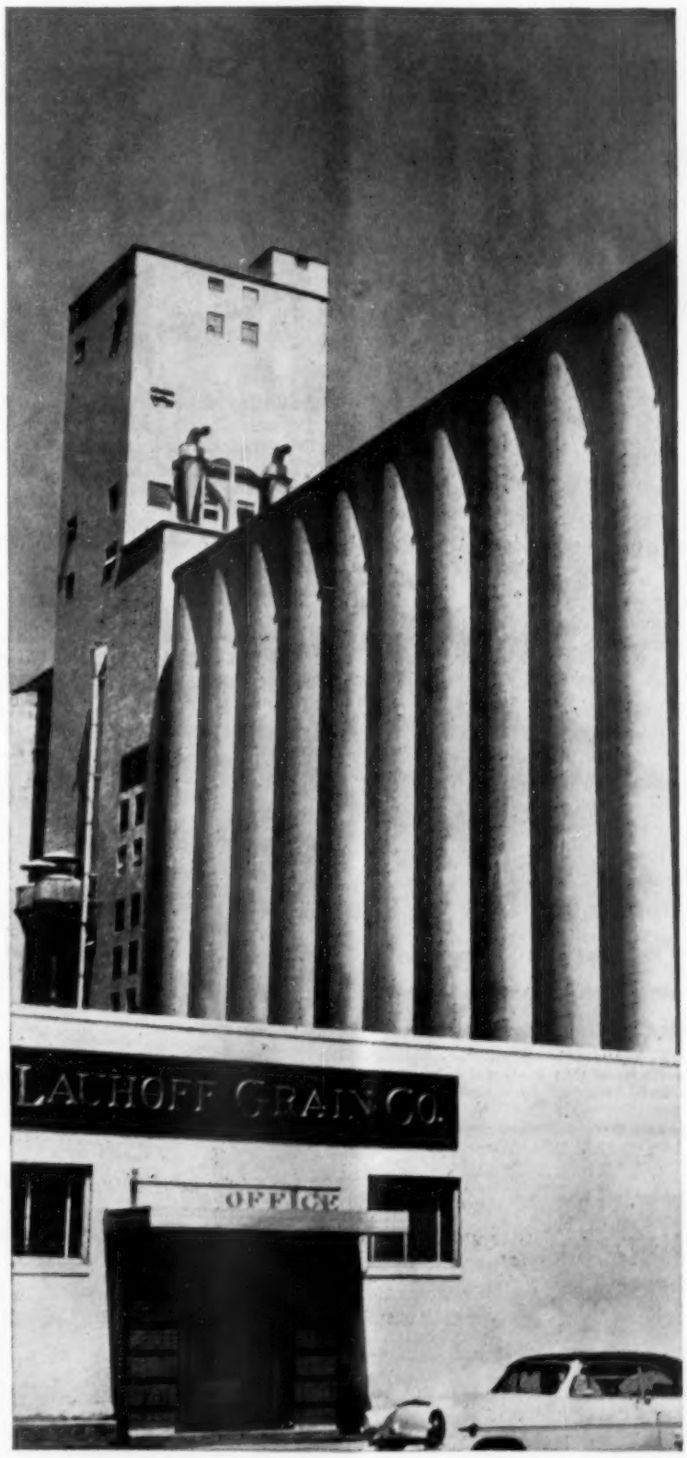
The III Coarse, IV Coarse and V Coarse rolls were set up by visual observation to give good cleaning up of the bran.

This equalization of releases with warm and cold wheat was necessary in the commercial test in order to maintain a reasonable balance of stock throughout the mill. In our earlier laboratory work, however, the rolls were set to exactly the same gap in each case, no attempt being made to counteract the fall in I Break release which occurred with warm wheat, although as previously noted the release was found to be made up automatically by the end of the third break.

As a result of this difference in technique in the commercial test

Break:	I	II Break Coarse	II Break Fine	III Break Fine	IV Break Fine	V Break Fine
Sieve No. (wire)	22	24	24	30	40	54
Aperture width (mm)	0.91	0.84	0.84	0.66	0.47	0.34
Release (%)	50	50	65	40	25	15

**This was also given by G. Highley Sugden of Henry Simon, Ltd., who supplied all the equipment in "Milling," Vol. 123, July 24, 1954, page 94. The process is described in British Patent Specification No. 723863 (and in various related foreign patents and patent applications) in which the inventors named are the authors of the present paper.



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there was less difference between cold and warm milled wheat in degree of breakage of the bran coats leaving the I Break rolls and, at the end of the system, the quantity of bran was not appreciably altered. Thus the proportions of the various contributors to offals were:

	Test A (cold)	Test B (warm)
Tails of:	%	%
Break system	10.7	10.4
Reduction system	4.66	4.1
IV Break coarse and fine purifiers	1.2	1.3
V Break purifier	2.1	2.4

The effects on the released stocks were marked and in line with those observed in the laboratory work. In the test with warm wheat appreciably less sizings and more small middlings were released by the break rolls, changes most noticeable in the purifier feeds. It was also very evident that, with warm wheat, grinding became much easier on the head reduction rolls, especially when wheat came on the mill at 41° C. instead of at 38° C.

It was necessary to ease off the first two coarse reductions appreciably in order to prevent the automatic overflow rolls on the first two fine reductions from running completely empty. The grinds on these four passages were described as being more characteristic of soft wheat milling than of a normal baker's mixture. This increased friability of the endosperm therefore confirmed the laboratory findings.

An outstanding impression formed by those engaged in the commercial tests was that by controlling the temperature immediately before the I Break the size of break chop could be varied at will. The effect was in fact similar to that of changing from a hard to a soft wheat mixture or from sharp flutes to flutes which were well run in or even becoming slightly dull. A change in wheat temperature of only 3-4° C. was quite obvious on the break rolls and it seemed that temperature control of the wheat at this point might provide a useful method of correcting the effect of very sharp or over dull flutes.

Comparisons

It was not clear, however, how far the smaller improvement in extraction rate and color of straight run flour found in the commercial tests was due to the different procedure in regard to break releases and how far it was due to other factors, including:

1. The use of stabilized wheat as a control on the commercial test whereas the laboratory controls had been cold-conditioned wheat. Preliminary observations in the commercial mill indicated that when the stabilizer was used the increase in quantity of coarse break chop was not so great as that previously noticed when warming cold-conditioned wheat.

2. The possibility that the over-all benefit of warm breaking might be diminished at 80% extraction. The laboratory tests had been made almost entirely on a white flour milling basis, the first and second break releases from the wheat milled at room temperature being only about 25% and 40% respectively. In one test, however, the first break release had been increased to 40% with the cold wheat, the warm wheat being afterwards put through the same roll setting. In this case the warm breaking again showed the usual improvements compared with the cold, the bran being obtained in greater yield and larger particle size whilst being equally well cleaned, the released stocks being purer and the flour of lower ash content. It was observed, however, that the reduction in yield of sizings and the corresponding increase in proportion of small middlings and break flour, due to the warm breaking, were relatively greater than they had been in the tests employing the smaller break releases.

3. The nature of the grist, which was composed partly of soft wheat while the laboratory grist had been all-Manitoba. It was noticed in the commercial test that above 41° C. the stocks became too mealy or woolly. This had not been evident to the same extent with all-Manitoba wheat in the laboratory, and it was conceivable that a somewhat lower temperature would suit the mixed grist better.

Further Laboratory Tests

In order to ascertain the importance of these factors, further laboratory tests were undertaken in which, instead of 100% Manitoba, a mixture of 80% Manitoba and 20% English wheat, at a moisture content of 16%, was milled at temperatures of 16° and 41° C. respectively.

Effect of stabilizing. In the first place the results showed the effects of warming cold-conditioned wheat immediately before breaking were similar to those of warming wheat which had previously been stabilized and cooled. This ruled out, therefore, the possibility that, since stabilized wheat was used in the commercial tests as a control, the effect of a second application of heat on milling properties might have been less marked because the wheat had already been heated.

Effect of heaviness of release. Further tests did however indicate the importance of the levels of release employed in the breaking system. Thus the behavior of the cold and warm wheat was compared on a four break system using heavy releases, as follows: I Bk. 50%; II Bk. 50%; III 28%; IV 16%. Although the usual "intermediate" milling effects (larger

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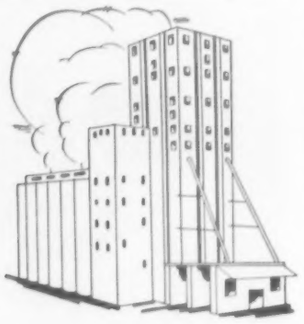

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	Cold wheat		Warm wheat	
	Yield %	Grade color value	Yield %	Grade color value
Break flour	26.1	5.8	29.6	5.6
Lower grade reduction flour	16.0	2.7	15.0	2.6
Rest reduction flour	57.9	2.0	55.4	1.4
Straight run flour	100.0	3.1	100.0	2.8

particle size of break chop, etc.) were noticed, together with a slightly improved break flour, there was substantially no difference in the straight-run flour, of about 70% extraction. However, when the break system was set to lighter releases (on the lines of pre-war milling) the color of the straight-run flour was slightly improved as a result of the warm breaking and, at the same time, its extraction rose from 70.1 to 71.5%, as a result, no doubt, of the easier reducibility of the released endosperm; furthermore the color of the patent flour was considerably improved. In these tests the break rolls were adjusted to the same setting for the cold and for the warm wheat, and the releases (expressed on total products of milling) were:

	I Break	II Break	III Break	IV Break
	%	%	%	%
Cold wheat	27	24	26	8
Warm wheat	22	28	27	9

The data given include grade color values for the three main grades of flour which together constituted the straight-run flour of about 70% extraction. The figures for yield are expressed as percentages of the total flour made. (See table above.)

The figures suggest that the improvement in the straight-run flour previously found in laboratory experiments is attributable to the effect on the top 55-60% of the white flour made rather than to any appreciable improvement of the lower grade flour.

Subsequent Commercial Experience

It may be claimed that the knowledge so far gained is a contribution to milling technology, particularly in the direction of control or standardization of processes, and that in this direction the commercial tests have borne out the laboratory findings. In this connection, since this article was written, A. G. Gowlett of J. W. French & Co., Ltd., has given us his impressions formed during several months' experience with the process. In general he has found that the process facilitates milling, and French's practice is now to run with the temperature of the first break feed controlled within the range 38-41° C.

Mr. Gowlett mentions the following particular points:

1. One advantage of the process is that it amounts to a rapid conditioning process for hard wheat. In his experience, by milling at not under 38° C., it is possible in emergency to put a baker's grist straight on to the mill from the washer (of course, via the heater) without any lying time. Formerly, with cold conditioning, 12 hours was the very minimum binning period if complaints from bakers were to be avoided.

It is outside our present scope to attempt an explanation of this finding. Presumably, although distribution of moisture within the wheat grains is unlikely to have attained uniformity when the wheat reaches the first break, this consideration is outweighed by the modification, already described, that occurs in friability of the endosperm when the warm wheat is engaged by the first break rolls.

2. French's break system has been re-balanced to suit the main effects of warm breaking. The first break rolls are no longer set extra closely in order to restore the release at that point to the cold wheat level.

3. The effect is shown not only on the proportions of coarse and fine break roll feeds but also in a reduced quantity of brown sizings. In general the bran is kept larger in particle size throughout the milling system. In appraising this feature, Mr. Gowlett remarks that, in practice, rolls handling larger bran fragments can be adjusted more satisfactorily than those handling small.

4. In keeping with the effect mentioned under 3, the purifiers have been found to supply improved stock to the head reduction rolls.

5. It has been found, perhaps rather surprisingly, that the pneumatic elevation from the first break does not completely cool down the stock. The feed to the I Bk. scalper (Flowmaster) is not below 32° C. To avoid condensation troubles the aspiration of this scalper has been increased. There is no sign of any adverse effect on dressing. The feed to the II Bk. is warm, but cooling is practically complete by the end of the elevation of the stock from that roll. Experience in the laboratory investigation suggests that the extra warmth in the II Bk. feed would have a beneficial effect on milling rather than otherwise.

6. Experience has shown no notable increase in evaporative loss as a result of milling warm wheat.

Effect on Baking Quality

Repeated laboratory tests have been made to ascertain whether variation in temperature at which the breaking system is carried out affects

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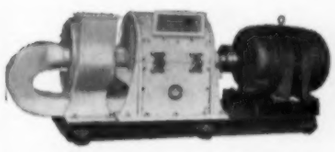

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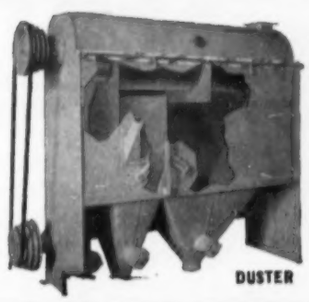

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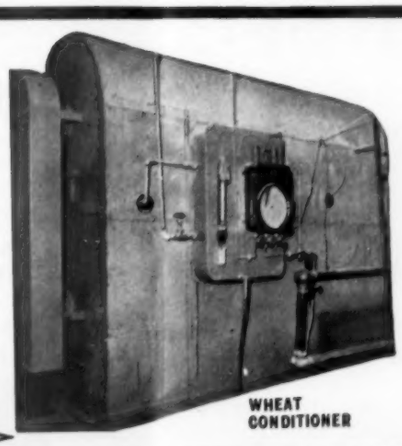

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These levels will be applied in random sampling of cars of wheat.

Excerpt from U.S. Health, Education and Welfare Food and Drug Administration Bulletin M2715

WASHINGTON, D. C.—The Food and Drug Administration has announced that it will tighten sanitary requirements on wheat beginning July, 1956, to promote increased cleanliness in the Nation's food supply.

George P. Larrick, Commissioner of Food & Drugs, stated that during the period January through July 31, 1955, wheat from 3,754 cars was examined. Of these, 29 cars were found to contain filth in excess of the rodent actionable level, and 3 cars showed insect damage to the extent of 2% or more of the kernels.

The Commissioner said: "Under the Program, substantial progress has been made in improving handling and storage of wheat to prevent contamination. However, experience acquired during the past six months shows that the levels of judgment should be tightened if the program is to continue to be effective."

the baking quality of the straight-run flour. On the whole it appears that loaf volume is unaffected but that color and grain of crumb are improved slightly but progressively with rise in breaking temperature (up to 54° C.) when the flour is baked without addition of chemical improver. This effect appeared to be "swamped" when the tests were made after addition of 10 or 15 p.p.m. of bromate, the loaves from milling tests at all temperatures between 20 and 54° C. then being similar.

Variation in breaking temperature was found to produce no significant effect on physical properties of dough. It should also be recorded that, on balance, results of sifting tests show little effect on granularity of the straight-run flour.

OGILVIE

(Continued from page 3a)

ment) and the Imperial Japanese Navy, as well as flour merchants and factors all over the world.

The company continued to grow. In 1923, the Alberta Milling Co. at Edmonton was taken over, and in 1925 the stockholders got some tangible proof of the firm's growth in the form of a three-for-one stock split.

During the slump of the 30's and ever since, Ogilvie has grown by diversifying its activities. Its products now include 12 baker's flours, specialty flours, five breakfast cereals, 20 ready cake and pudding mixes (it introduced these last into Canada), wheat germ, wheat starch, gluten, mono-sodium glutamate, 32 animal feeds and two complete ranges of compounds—in all, 50,000 bags of flour, feed and cereals a day, as well as the baby foods made by Gerber-Ogilvie Baby Foods, Ltd., a company formed in association with the U.S. baby foods firm, Gerber Products Co.

Peter H. Walmsley

BRANCH MANAGER — Peter H. Walmsley has been appointed manager of the New Orleans branch of Fulton Bag & Cotton Mills. A native of New Orleans, upon graduation from Princeton in 1949, he joined Fulton's New Orleans organization. Most recently he has been serving as assistant branch manager and aide to Jason M. Elsas, who was New Orleans branch manager as well as vice president and general manager of Fulton's national bag division. Mr. Elsas will now devote full time to the duties of vice president and general manager of Fulton's national bag division operations.

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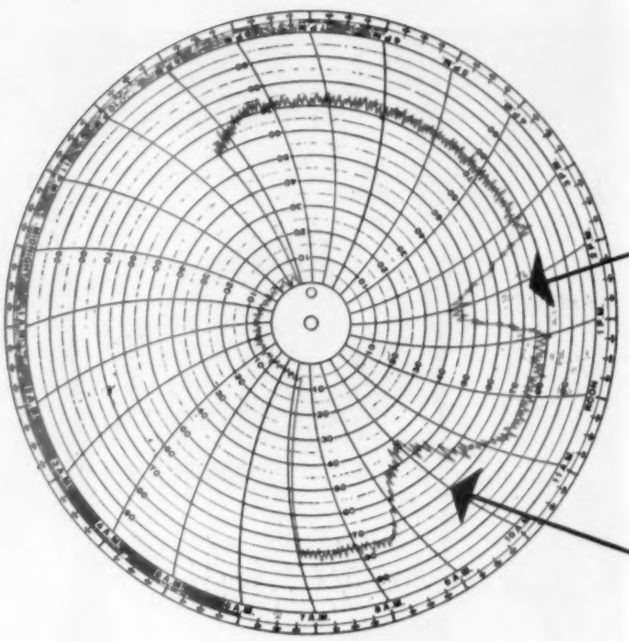

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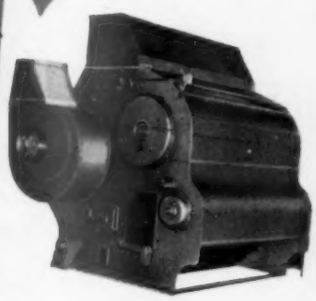

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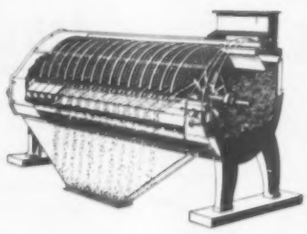

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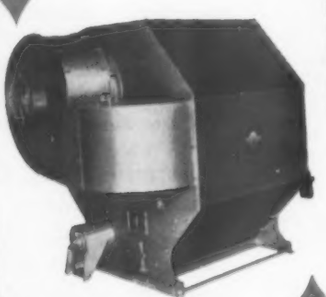

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